DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 2

Topic :- WORK ENERGY AND POWER

1 **(a)**

$P = Fv$

$= 9000\text{N} \times 2\ \text{ms}^{-1} = 18000\text{Js}^{-1}$

$= 18000\ \text{W} = 18\ \text{kW}$

2 **(a)**

$\vec{\mathbf{F}} = \frac{\partial U}{\partial x}\hat{\mathbf{i}} - \frac{\partial U}{\partial y}\hat{\mathbf{j}} = 7\hat{\mathbf{i}} - 24\hat{\mathbf{j}}$

$|\vec{\mathbf{F}}| = \sqrt{(7)^2 + (-24)^2} = 25$ unit

3 **(b)**

In case of elastic collision ,coefficient of restitution e=1

or

Relative speed of approach =relative speed of separation.

$\therefore$ Option (b)is correct.

4 **(d)**

Initial momentum $= \vec{P} = mv\hat{i} + mv\hat{j}$

$|\vec{P}| = \sqrt{2}mv$

Final momentum $= 2m \times V$

By the law of conservation of momentum

$2m \times V = \sqrt{2}\ mv \Rightarrow V = \frac{v}{\sqrt{2}}$

In the problem $v = 10\ m/s$ [Given] $\therefore V = \frac{10}{\sqrt{2}} = 5\sqrt{2}\ m/s$

5 **(c)**

$p = \sqrt{2ME}\ \therefore \frac{p_1}{p_2} = \sqrt{\frac{m_1}{m_2}\frac{E_1}{E_2}} = \sqrt{\frac{2}{1} \times \frac{8}{1}} = \frac{4}{1}$

7 **(c)**

$W = \frac{1}{2}k(x_2^2 - x_1^2) = \frac{1}{2} \times 5 \times 10^3(10^2 - 5^2) \times 10^{-4} = 18.75\ J$

8 **(c)**

Work done $=$ force $\times$ distance $=$ 4 N $\times$ 2 m $=$ 8 J

9 **(d)**

$U = \frac{a}{x^{12}} - \frac{b}{x^6}$

$F = -\frac{dU}{dx} = +12\frac{a}{x^{13}} - \frac{6b}{x^7} = 0 \Rightarrow x = \left(\frac{2a}{b}\right)^{1/6}$

$U(x = \infty) = 0$

$U_{\text{equilibrium}} = \frac{a}{\left(\frac{2a}{b}\right)^2} - \frac{b}{\left(\frac{2a}{b}\right)} = \frac{b^2}{4a}$

$\therefore U(x = \infty) - U_{\text{equilibrium}} = 0 - \left(-\frac{b^2}{4a}\right) = \frac{b^2}{4a}$

10 **(a)**

By conservation of energy, $mg\text{h} = \frac{1}{2}mv^2$

$\Rightarrow v = \sqrt{2g\text{h}} = \sqrt{2 \times 9.8 \times 1} = \sqrt{19.6} = 4.43\ m/s$

11 **(b)**

If a body falls from height h, then from equation of motion we know that it will hit the ground with a velocity say u=$\sqrt{2g\text{h}}$ which is also the velocity of approach here. Now, if after collision it gains a height h_1 then again by equation of motion $v = \sqrt{2g\text{h}}$, which is also the velocity of separation .so, by definition of e,

$e = \sqrt{\frac{2g\text{h}_1}{2g\text{h}}}\ or\ \text{h}_1 = e^2\text{h}$

Given ,h=20 m, e=0.9

$\therefore$ height attained after first bounce

$\text{h}_1 = (0.9)^2 \times 20$

$= 0.9 \times 0.9 \times 20$

$= 16.2$

12 **(c)**

Velocity of fall is independent of the mass of the falling body

13 **(b)**

Work done = Force $\times$ displacement

= Weight of the book $\times$ Height of the book shelf

15 **(c)**

$P = Fv = m.\frac{dv}{dt} \cdot v$

$\int v\,dv = \int \frac{p}{mdt};\ \frac{v^2}{2} = \frac{pt}{m}$

$v = \sqrt{\frac{2p}{m}}t^{1/2}; \frac{dx}{dt} = \sqrt{\frac{2p}{m}}t^{1/2}$

$\int dx = \sqrt{\frac{2p}{m}}\int t^{1/2}dt;$

$x = \sqrt{\frac{2p}{3}}\frac{t^{3/2}}{3/2} = \frac{2}{3}\sqrt{\frac{2p}{3}}t^{3/2}$

$x \propto t^{3/2}$

16 **(b)**

$$K = \frac{\text{mass}}{\text{length}} = \frac{dm}{dt}$$

$$\text{KE} = \frac{1}{2}mv^2 \Rightarrow \frac{d}{dt}(\text{KE}) = \frac{1}{2}\left(\frac{dm}{dt}\right)v^2$$

$$= \frac{1}{2}\left(\frac{dm}{dx} \times \frac{dx}{dt}\right)v^2$$

$$= \frac{1}{2}kvv^2 = \frac{1}{2}kv^3$$

17 **(c)**

Area of acceleration–displacement curve gives change in KE per unit mass

$\frac{1}{2}m(v^2 - u^2) = F.S = \frac{mdv}{dt} \times s$

$$\therefore \frac{\text{change in } KE}{\text{Mass}} = \frac{dv}{dt} \times s$$

18 **(c)**

Force required to move with constant velocity

$\therefore$ Power $= FV$

Force is required to oppose the resistive force R and also to accelerate the body of mass m with acceleration a

$\therefore$ Power $= (R + ma)V$

19 **(b)**

1. If the surface is smooth then the kinetic energy at B never be zero

2. If the surface is rough, the kinetic energy at B be zero. Because, work done by force of friction is negative. If work done by friction is equal to $m$gh then, net work done on body will be zero. Hence, net change in kinetic energy is zero. Hence, (b) is correct

3. If the surface is rough, the kinetic energy at B must be lesser than $m$gh. If surface is smooth, the kinetic energy at B is equal to $m$gh

4. The reason is same as in (a) and (b)

20 **(b)**

$k_A > k_B$, x is the same

$$\therefore \frac{1}{2}k_A x^2 > \frac{1}{2}k_B x^2 \Rightarrow W_A > W_B$$

Forces are the same

$k_A x_A = k_B x_B$, As $k_A > k_B$, $x_A < x_B$

$W'_A = \frac{1}{2}(k_A x_A)x_A$ and $W'_B = \frac{1}{2}(k_B x_B)x_B$

$\therefore W'_A < W'_B$; $\therefore W_A > W_B$ but $W'_A < W'_B$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	A	B	D	C	B	C	C	D	A
Q.	11	12	13	14	15	16	17	18	19	20
A.	B	C	B	A	C	B	C	C	B	B